CanadianSolar

INSTALLATION MANUAL ANNEX OF STANDARD SOLAR MODULE

ANNEX A: ALTERNATIVE MOUNTING METHODS |3
ANNEX B: ALTERNATIVE GROUNDING METHODS |10
ANNEX C: MODULE SPECIFICATION |15
ANNEX D: MODULE CLEANING GUIDELINE |18
AMENDED EDITIONS AND DATES |19

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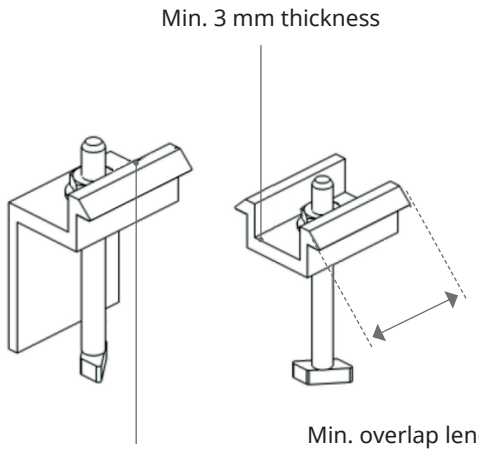
ANNEX A: ALTERNATIVE MOUNTING METHODS

All the basic requirements of the main installation manual should apply to the alternative mounting methods, unless otherwise specified.

MOUNTING METHOD A CLAMPING

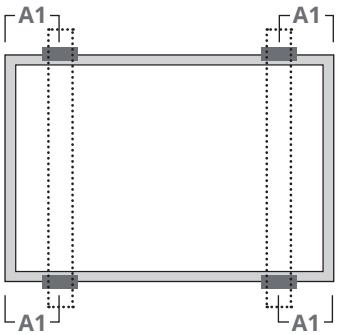
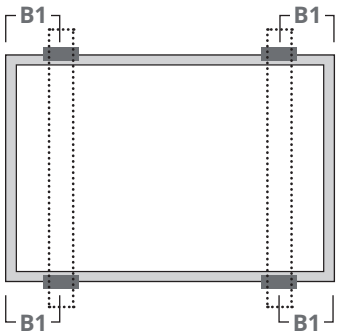
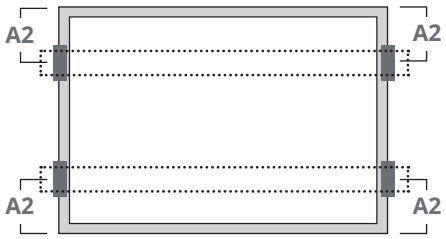
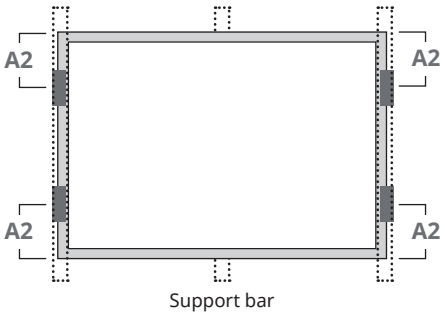
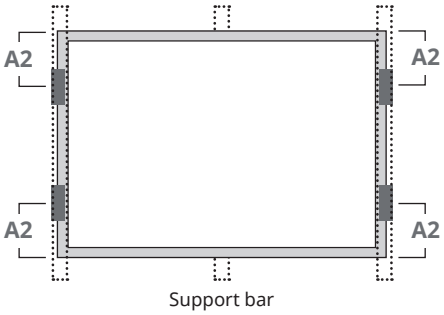
- The mounting method has been qualified by Canadian Solar Inc. and certified by VDE and CSA.
- Top or bottom clamping methods can vary and are dependent on the mounting structures. The installer shall follow the mounting guidelines, recommended by the mounting system supplier.
- Each module must be securely fastened at a minimum of 4 points on two opposite sides. The clamps should be positioned according to the authorized position ranges defined in table A-1. Install and tighten the module clamps to the mounting rails using the torque stated by the mounting hardware manufacturer. M8 size bolt and nut are used for clamping method. Tightening torques should be within 10~17 Nm (7.4~12.5 ft-lbs) for M8 x 1.5 coarse thread bolts, depending on bolt class.
- Different recommendations from specific clamping hardware suppliers should prevail. System designer and installer are responsible for load calculations and for proper design of support structure.
- Canadian Solar Inc. warranty may be void in cases where improper clamps or unsuitable installation methods are found. When installing inter-modules or end type clamps, take measures so as:

  (1) Not to bend the module frame
  (2) Not to touch or cast shadow on the front glass
  (3) Not to damage the surface of the frame
  (4) To ensure the clamps overlap the module frame by at least 0.2 in (5 mm).
  (5) To ensure the clamps overlap length is at least 1.57 in (40 mm).



- Clamp material should be anodized aluminum alloy.
- Floating type clamps are not authorized.
- Clamp positions are of crucial importance for the reliability of the installation, the clamp centerlines must only be positioned within the ranges indicated in table A-1, depending on the configuration and load.
- For configurations where the mounting rails run parallel to the clamps installation side, precautions should be taken to ensure the module frame (C-shape) overlap the rail by 0.59 in (15 mm) or more.

Table A-1:
Authorized attachments for clamping method

	Uplift load ≤ 2400 Pa **Downforce load ≤ 2400 Pa**	**Uplift load ≤ 2400 Pa** **2400 Pa ≤ Downforce load ≤ 5400 Pa**
Clamping on long side frame	Use 4 clamps on the long side, the allowed range depends on the module type.  Mounting rails shall run perpendicularly or parallel to the long side frame .	Use 4 clamps on the long side, the allowed range depends on the module type.  Mounting rails shall run perpendicularly or parallel to the long side frame .
Clamping on short side frame	Use 4 clamps on the short side, the allowed range depends on the module type. Mounting rails shall run parallel or perpendicularly to the short frame side.  For CS5P and CS6P series, an additional support bar should be placed below the module where download force above 1600Pa is expected. Mounting rails should run parallel to the short side frame .  Support bar	Use 4 clamps on the short side, the allowed range depends on the module type. An additional support bar should be placed below the module.  Support bar Mounting rails should run parallel to the short side frame .

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Authorized range for clamping as a function of model type:

Model type	A1 range (mm)	B1 range (mm)	A2 range (mm)
CS5A	220 – 380	330 – 400	170 – 200
CS5AH	120 – 170	120 – 170	170 – 200
CS5P	220 – 390	330 – 400	220 – 270
CS6A	220 – 340	270 – 330	200 – 250
CS6P, CS5T	240 – 410	340 – 410	200 – 250
CS6X	340 – 550	410 – 490	200 – 250
CS6V	240 – 410	340 – 410	170 – 210
CS6VH	130 – 210	160 – 210	170 – 210
CS6K	247.5– 410	247.5– 330	200– 250

MOUNTING METHOD B INSERTION SYSTEMS

- The mounting method has been qualified by Canadian Solar Inc. and certified by VDE and CSA.
- Insertion methods can vary and are dependent on the mounting structures. The installer shall follow the mounting guidelines, recommended by the mounting system supplier.
- Each module must be securely fixed through all its length on two opposite sides. Install and tighten the insertion profiles to the support structure using the hardware and instructions provided by the mounting system manufacturer. System designer and installer are responsible for load calculations and for proper design of support structure.
- Canadian Solar Inc. warranty shall be void in cases where improper insertion systems or unsuitable installation methods are found. When installing insertion profiles, take measures so as:

  ① Not to bend the module frame
  ② Not to touch or cast shadow on the front glass
  ③ Not to damage the surface of the frame
  ④ To ensure the insertion profiles overlap the module frame by at least 0.39 in (10 mm).
  ⑤ To ensure the module frame (C-shape) overlap the insertion profiles by at least 0.59 in (15 mm).
  ⑥ To ensure insertion profile thickness and tolerance suits module thickness 1.57 in (40 mm) for most of Canadian Solar inc modules).

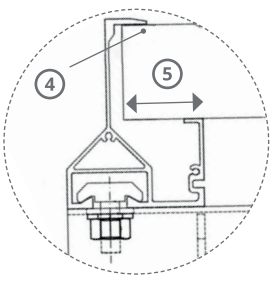
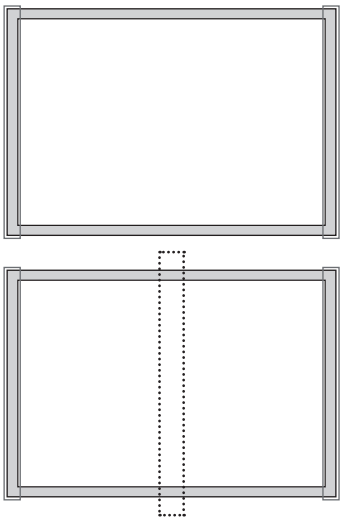
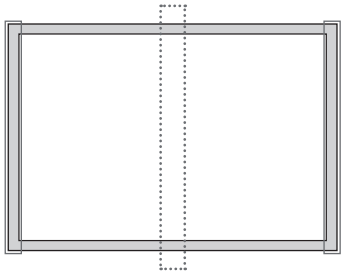
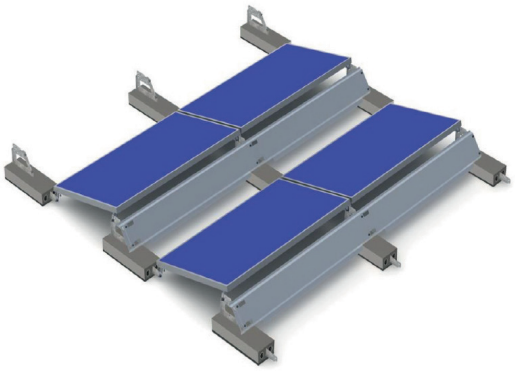


Table A-2: Authorized attachments for insertion method

	Uplift load ≤ 2400 Pa Downforce load ≤ 2400 Pa	Uplift load ≤ 2400 Pa 2400 Pa ≤ Downforce load ≤ 5400 Pa
Insertion profile on long side frame		Use 2 insertion profiles running parallel to the long side frame. For CS6X series, installations where the downforce load can reach up to a 5400 Pa are authorized.
Insertion profile on short side frame	 Use 2 insertion profiles running parallel to the short side frame. For CS5P and CS6P series, an additional support bar should be placed below the module where download force above 1600 Pa is expected.	 Use 2 insertion profiles running parallel to the short side frame. An additional support bar should be placed below the module. For CS6X series, installations where the downforce load can reach up to a 5400 Pa are authorized.

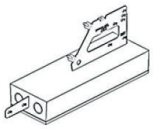
MOUNTING METHOD C
Grizzly Bear® FR Gen II SYSTEM

· Grizzly Bear® FR Gen II System has been qualified by Intertek (ETL) to UL2703 for use with Canadian Solar Inc. modules.



Components

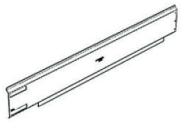
Support



Claw I

Long Claw

Wind Deflector



Wind Deflector End Plate

Fastener Kit

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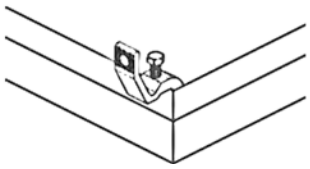
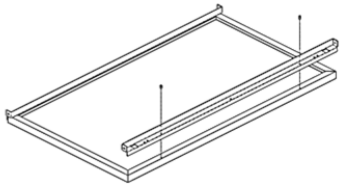
Table A-3: Authorized attachments for Grizzly Bear® FR Gen II SYSTEM

Claw	Compatible Modules	Installation Methods
Claw I 	CS5A series, , CS5T-M, CS6P series, CS6A series, CS6X series Only 1600Pa is authorized for CS6P/CS6X without support bar.	Place a PV module face down on protected work surface and place a Claw over the module frame flange on the short side of the module; slide to the corner and tighten the 3/8-16 x 1.25" 18-8 hex head cap screw between 24.4 and 27.1 Nm (18-20 ft-lb). Ensure that the Claw is seated up against the flanges of both the long and short sides of the module. Each module must be fitted with four (4) Claws.
Long Claw 	CS6X-M, CS6X-P	This Claw is used for PV modules that are not compatible with flange clamp style Claws. The Long Claw attaches at the module mounting holes using standard bolting method. Refer to paragraph 6.1 for suitable torque and fastening requirements.

· Refer to Grizzly Bear® FR Gen II Installation Manual (9910010 Rev A) from PanelClaw Inc. for more information and always follow latest safety procedures when installing.
Failure to follow corresponding regulatory instructions will void Canadian Solar Inc. module warranty.

MOUNTING METHOD D
ATI CLAMPING

- The mounting method has been qualified by Canadian Solar Inc. and certified by CSA.

- Array Technology Inc. (ATI) uses a clamp mounting method for attaching modules to the tracker assembly. The clamp mounting method involves installing a module mounting clamp assembly on the torque tube, attaching a module, and then another clamp assembly until the row of modules is installed. Clamps may also be installed earlier, when bearing housings are installed on torque tubes.

- Canadian Solar Inc. qualified 2 kinds of ATI clamps, 12 in (304.8mm) length standard clamp and 12 in (304.8mm) length high-clearance clamp. Both clamps are mounted on long side frame, in the middle position (with Universal Clamp Module Jig), so that the module is evenly divided in half by the torque tube.

- End clamps are attached to the module at the end of each array and in the middle next to the gear drive. Four end clamps are used for each row of modules. End clamps are at least 22 in (558.8mm) long and have four attachment holes. End clamps also include a spacer plate (fabricated for each specific module) that must be inserted in the clamp on the outside of the clamp (opposite the end module) to maintain a balanced force with the end module.

- The top module edge must engage the clamp a minimum of 0.375 in (9.5 mm) on the top clamp edge and the bottom module edge must engage a minimum of 0.69 in (17.5 mm) on the bottom clamp edge. If these distances cannot be measured, a total of 0.062 in (1.57 mm) of gap is allowed between the module and both clamps. This gap can be offset to one side or split between the clamps.

- All the clamp assemblies, spacer plate, and hard ware should be tightened to the torque tube with a torque setting of 18 ± 3 Nm (13 ± 2 ft-lbs), using the long bolts provided (bolt length is dependent on model used).

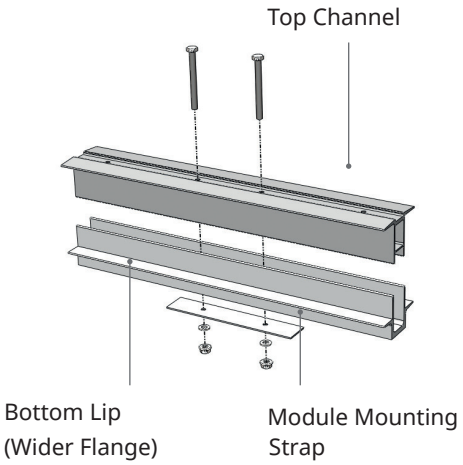
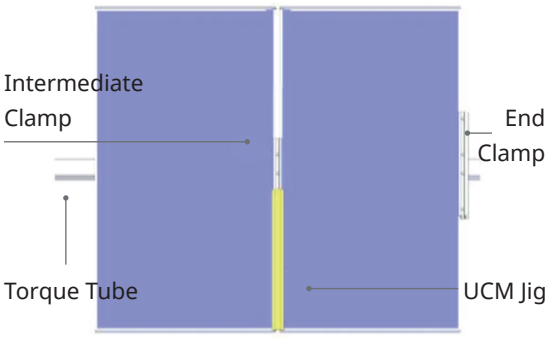


Table A-4: Authorized attachments for ATI clamping

	CS6P Series	CS6X Series
12-inch length standard clamp	Uplift load ≤ 1200 Pa Downforce load ≤ 1200 Pa	Uplift load ≤ 2400 Pa Downforce load ≤ 5400 Pa
12-inch length high-clearance clamp	Uplift load ≤ 1200 Pa Downforce load ≤ 3600 Pa	Uplift load ≤ 2400 Pa Downforce load ≤ 5400 Pa

- Refer to DuraTrack™HZ Solar Tracker Installation Guide (November 2012, Rev. B-01) from Array Technologies Inc. for more information and always follow latest safety procedures when installing. Failure to follow corresponding regulatory instructions will void Canadian Solar Inc. module warranty.



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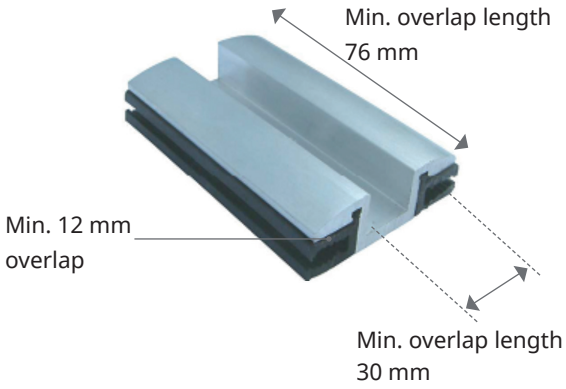
MOUNTING METHOD E FOR SPECIFIC MODULE RANGES

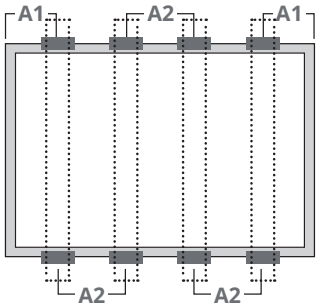
FLOATING CLAMPED CONFIGURATION (ONLY FOR CS5A-M-L LAMINATE MODEL)

- The mounting method has been certified by CSA.
- Clamping methods can vary and are dependent on the mounting structures. The installer shall follow the mounting guidelines, recommended by the mounting system supplier.
- Each laminate must be securely fastened at a minimum of 8 points on the two opposite long sides. Clamp positions are of crucial importance for the reliability of the installation, the clamp centerlines must only be positioned within the ranges indicated in table A-5. Install and tighten the module clamps to the mounting rails using the torque stated by the mounting hardware manufacturer (in the absence of instructions, Canadian Solar Inc. recommends a torque about 15 Nm to 20 Nm (11.1 to 14.7 ft-lbs)). System designer and installer are responsible for load calculations and for proper design of support structure.
- Clamp material should be aluminum. EPDM type rubber or similar material should be used between the laminate/clamp and laminate/mounting rail interfaces in order to prevent any damages to the laminate.
- Canadian Solar Inc. warranty shall be void in cases where improper clamps or unsuitable installation methods are found. When installing inter-modules or end type clamps, take measures so as:
  1. Not to bend the laminate excessively
  2. Not to cast shadow on the cells
  3. Not to damage or scratch the surface of the glass and backsheet
  4. To ensure the clamps overlap the module glass by at least 0.47 in (12 mm).
  5. To ensure the clamps overlap length is at least 3.0 in (76 mm).
  6. To ensure a minimum contact area of 1.57 in x 1.18 in (40 mm x 30 mm) between the clamp and the mounting rails (rail thickness should be at leat 1.57 in (40 mm)).
  7. To use clamps of appropriate thickness, allowing the CS5A-M-L 0.157 in (4 mm) glass laminate to be fixed floatingly.



- Vertical (landscape) mounting of the laminate is not authorized unless appropriate safety hooks are used to secure the laminate against sliding-off.

Table A-5: Authorized attachments for CS5A-M-L laminate

	Uplift load ≤ 2400 Pa Downforce load ≤ 2400 Pa	Uplift load ≤ 2400 Pa 2400 Pa ≤ Downforce load ≤ 5400 Pa
Clamping on long side frame	 A1 = 286 mm A2 = 334 mm Use 4 clamps on the long side, at the positions defined above (tolerance ±20 mm). Mounting rails shall run perpendicularly or parallel to the long side frame.	Not allowed
Clamping on short side frame	Not allowed	

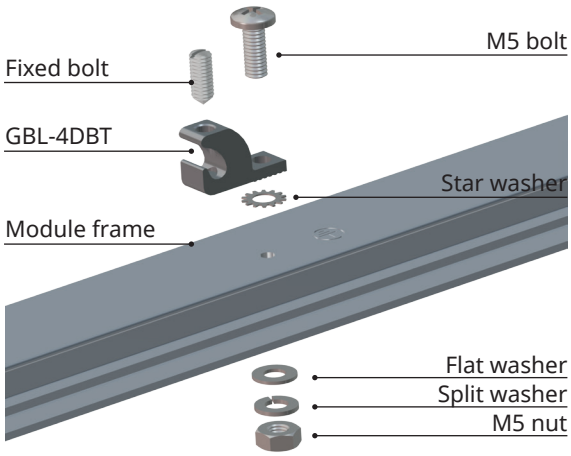
ANNEX B: ALTERNATIVE GROUNDING METHODS

All the basic requirements of the main installation manual should apply to the alternative grounding methods, unless otherwise specified.

GROUNDING METHOD A
LAY-IN-LUG + STAR WASHER

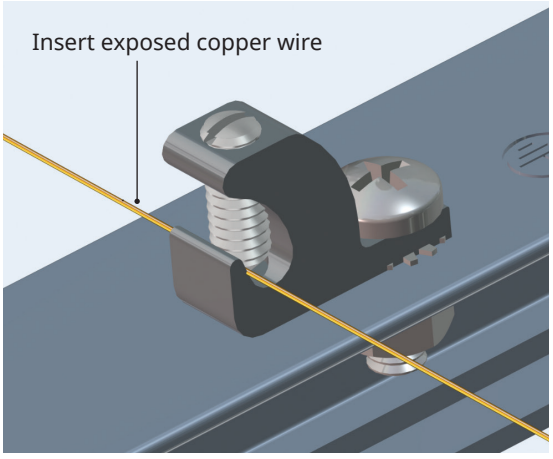
Used with 0.20 in (5 mm) standard grounding holes (CSA certified)

- Canadian Solar Inc. recommends the use of lay-in lugs certified to UL467 and UL2703 standards as general method for grounding module frames.
- Tin-plated copper lay-in-lugs such as model GBL-4DBT from Ilsco (UL NO. E354420) is acceptable hardware choice.
- Assemble the grounding lug to the aluminum frame using stainless steel M5 screw and hardware as shown per below picture. The star washer is fitted directly under the lay-in lug and makes electrical contact by penetrating the anodized coating of the aluminum frame. The screw assembly is further fitted with a flat washer, then a split washer and finally a nut to secure the entire assembly.



Refer to the installation manual provided by your grounding hardware supplier for more information, such as proper preparation of the aluminum frame surface. Always follow safety procedures when installing. Failure to follow regulatory instructions will void Canadian Solar Inc. module warranty.

- A torque moment of about 3±1 Nm (2.2 ft-lbs) should be used to fasten the lay-in-lug to the module frame. Different recommendations from specific grounding hardware suppliers should prevail.
- Insert the grounding wire (10-12AWG solid or stranded copper wire is recommended) within the lug cavity, and screw down the slotted screw using torque values stated by the supplier (depending on selected conductor diameter). Be careful not to damage the copper wire.
- The bolts, nuts, flat washers, split washers or other relevant hardware should be made of SS304 stainless steel, unless otherwise specified by the grounding hardware supplier.



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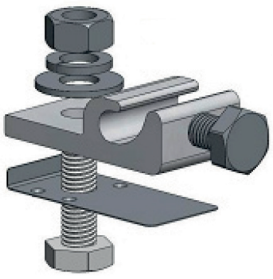
GROUNDING METHOD B
UGC-1 CLIPS + WEEBLUG 6.7

Used in conjonction with SolarMount® rails from UNIRAC, no hole is requested (INTERTEK certified).

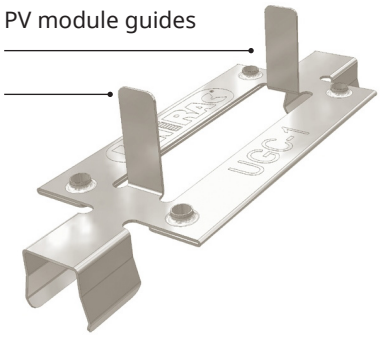
- UGC-1 grounding clips are used to create grounding path between the module frame and the UNIRAC rail. WEEBlug 6.7 assemblies are designed for use with size 6-12 AWG solid copper conductor wire, and allow connecting the system to equipment ground connector.

- Refer to Unirac Code-Compliant Installation Manual (Pub 140130 -1cc) from UNIRAC for more information. Always follow safety procedures when installing. Failure to follow SolarMount Rail System regulatory instructions will void Canadian Solar Inc. module warranty.

WEEBLug



UGC-I



GROUNDING METHOD C
RAPID2+ GROUNDING MIDDLE CLAMPS

Used in conjonction with any Schletter© module mounting rail (INTERTEK certified)

- Schletter Rapid^{2+} Grounding Clamps are used to create a grounding path between the module frame and the mounting rail. An integrated grounding pin ensures bonding to the module frame by penetrating the frame coating. The Rapid^{2+} Clamp includes integrated grounding as a standard feature.

- The clamps have overall dimensions of 3.94 in x 1.40 in (100 mm x 35.5 mm), respectively length by width) and are rated to 10 AWG solid copper conductor wire.

- To install, simply position the clamp over the mounting rail and insert the pointed clamp end into the rail groove. Next, tighten the Rapid Grounding Clamp using a standard drill, using a torque of no more than 14.3 Nm (10.5 ft-lbs) to fasten the clamp hardware (M8 x 55 Torx and M8 nut). Use of a hammer drill is not recommended. The quantity of Rapid^{2+} Grounding Clamps is determined solely by the module layout.

- Refer to Schletter Rapid^{2+} Clamp installation instructions for more information and always follow safety procedures when installing. Failure to follow Rapid^{2+} Clamp regulatory instructions will void Canadian Solar Inc. module warranty.

GROUNDING METHOD D
GROUNDING FOR
GRIZZLY BEAR® FR GEN II SYSTEM

Only for PanelClaw Grizzly Bear® FR Gen II mounting system (INTERTEK certified)

- All PanelClaw mounting attachments or “Claws” have been tested to and are certified under UL Subject 2703 to act as a module and racking equipment grounding conductor (EGC) device. This certification allows the Claw into module and Claw into Support connection to serve the purpose of a copper EGC that would typically run to each module and Support. When grounding devices are installed according to the approved methodology and capacity, then the connections described above meet all the requirements outlined in NEC 690.43.

- Each Claw to Claw, and Claw to module connection has been certified for 120A. Determine the quantity of strings that a bonding jumper connection can accommodate based on the module series fuse rating and bonding jumper size as below. Verify that all devices used in connecting this bonding jumper can accommodate the conductor being used.

- Refer to Grizzly Bear® FR Gen II Installation Manual (9910010 Rev A) from PanelClaw for more information and always follow safety procedures when installing. Failure to follow PanelClaw regulatory instructions will void Canadian Solar Inc. module warranty.

Module Series Fuse Rating / DC String Fuse Rating (A)	Size of Bare Cu Bonding Jumper (AWG)			
	#12	#10	#8	#6
	Allowable Ampacity of Conductor (A)			
	15	50	90	120
	Number of Strings per Bonding Jumper			
10	1	5	9	12
15	1	3	6	8

Refer to this combination of module series fuse rating and bonding jumper size not being allowed due to ampacity limitations. Please use a larger conductor in order to achieve an allowable combination.

GROUNDING METHOD E
ATI SS CLIPS AND WEEB FOR ATI TRACKER

Only for ATI duratrack HZ Solar Tracker (CSA certified)

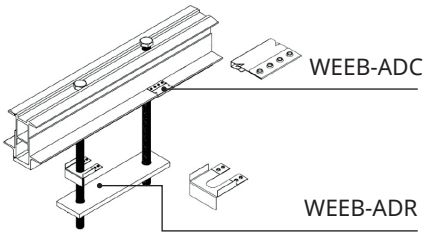
- There are two optional grounding methods for ATI duratrack HZ Solar Tracker. ATI provides an integral grounding means referred as ATI SS Clips, another alternative is the use of specific WEEB grounding clips.

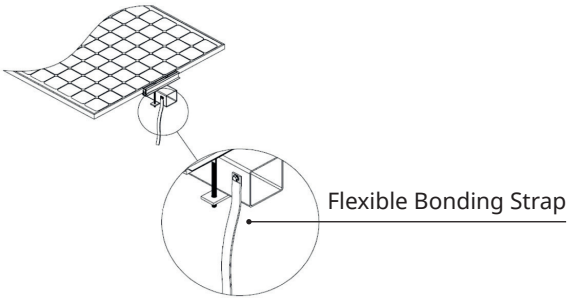
- The ATI SS Clips have been tested and are certified for bonding purpose under UL Subject 3703 certification for ATI Duratrack HZ tracker. The ATI SS Clips are used to create a grounding path between the module frame and ATI clamps.

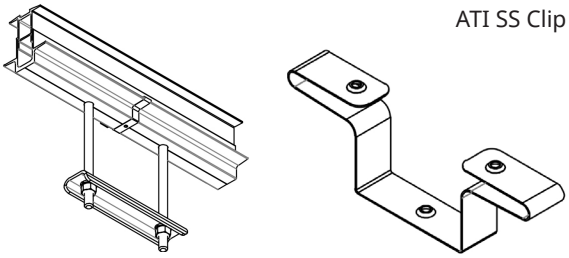
- The WEEB (Washer, Electrical Equipment Bond) clips have been tested to and are certified as recognized component under UL Subject 2703.

- The WEEB clips are used to create a grounding path between the module and ATI clamps (WEEB-ADC), as well as between ATI clamps and torque tube (WEEB-ADR).

- A flexible bonding strap can be used for bonding the Torque Tube to the Support Columns.







- The grounding clips and WEEBS are for SINGLE USE ONLY! Do not torque fasteners down if position of solar modules is not finalized. Only slightly tighten fasteners to keep modules in place.

- Fasten the ATI clamps with a torque setting of 18 ± 3 Nm (13.3 ft-lbs), and the flexible bonding strap with a torque setting of 5 Nm (3.7 ft-lbs).

- Refer to WEEB installation instructions for ATI DuraTrack HZ mounting system only(50018785 Rev C) from Burndy LLC and DuraTrack™HZ Solar Tracker Installation Guide (June,2014, Rev. B-02) from Array Technologies Inc. for more information and always follow safety procedures when installing. Failure to follow the instructions will void Canadian Solar Inc. module warranty.

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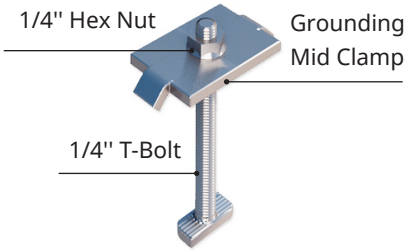
GROUNDING METHOD F IRONRIDGE RAILS WITH INTEGRATED GROUNDING

Only for IronRidge Inc. standard (XRS) and light (XRL) rails with integrated grounding (INTERTEK certified to UL2703).

- Grounding is accomplished by Grounding Mid Clamps retention teeth that penetrate the anodized coating of the photovoltaic modules frame to contact the metal, creating a bonded connection from module to module.
- In addition the Grounding Mid Clamps stainless steel T-Bolt's serrations penetrate the anodized coating of the XRL Rail and XRS Rail, creating a bonded connection from module to rail.
- Grounding Strap is used as additional bonding for grounding, creating a bonded connection from rail to rail.
- Grounding of each end rail can be done using any NRTL approved Grounding Lug. Secure the grounding lug to the XRL Rail or XRS Rail's top slot using hex bolt, flat washer, split lock washer, and nut.

Grounding Mid Clamp

Secures PV modules to rails and provides grounding to the rail and between the two adjacent modules.

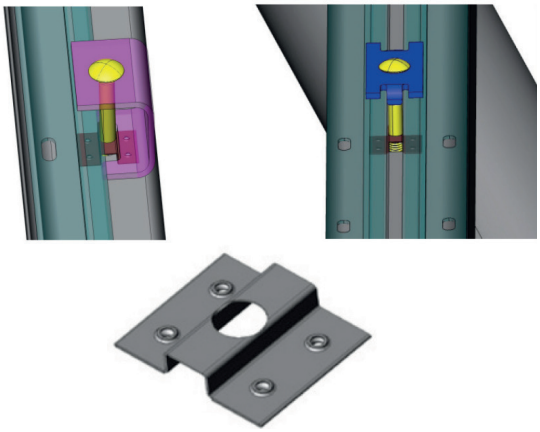


- Fasten the grounding mid clamps with a torque setting of 9.5± 2 Nm (84 in-lbs).
- Refer to Standard (XRS) and Light (XRL) Rails with Integrated Grounding Installation Manual (2013 Edition v1.13) from IronRidge Inc. for more information. Always follow safety procedures when installing. Failure to follow the regulatory instructions will void Canadian Solar Inc. module warranty.

GROUNDING METHOD G: WEEB-DPF GROUNDING CLIP FOR COSMA TOP CLAMP

Only for Cosma/Magna top clamp mounting system (CSA certified).

- The WEEB-DPF grounding clips have been tested and are certified as recognized component under UL Subject 2703.
- The WEEB-DPF grounding clips are used to create a grounding path between the module frame and the Cosma East/West mounting rails.
- Any NRTL approved grounding lug assembly can be used for grounding each Cosma mounting rail, after drilling bolt clearance hole Ø 0.33 in (8.4mm) on center of vertical rail support.
- The WEEB-DPF must be used in conjunction with the module clamps in alternating rows starting with the second column of clamps at the West end of the table working towards the East. The WEEB-DPF must fully contact the module frames and the E/W rail.
- WEEBs are for SINGLE USE ONLY! Do not torque fasteners down if position of solar modules is not finalized.
- Fasten the Cosma top clamps with a torque setting of 14 ± 2 Nm.

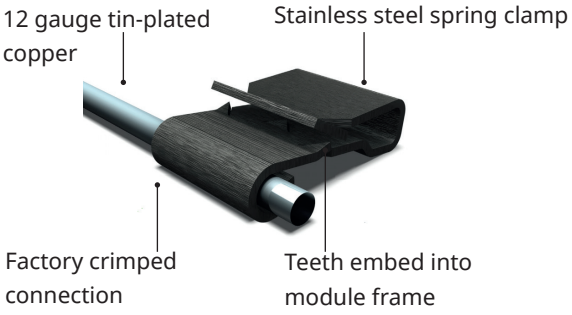


- Refer to Ground Mount Racking Structure Assembly Instructions (V1.5_7196_CEC0022_02-21-2013) from Cosma for more information and always follow safety procedures when installing. Failure to follow Cosma regulatory instructions will void Canadian Solar Inc. module warranty.

GROUNDING METHOD H
DYNORAXX® DYNOBOND CLIPS

Used in conjunction with any Canadian Solar Inc. standard modules, long or short frame installation (CSA certified)

- The DynoRaxx® DynoBond clips have been tested and are certified as recognized component under UL467 and UL Subject 2703. The UL listing number is E357716.
- The DynoBond clip is used as a jumper between modules acting as a bridge for the equipment ground path, up to a maximum overcurrent protection level of 15 A.
- The DynoBond clip consists of two stainless steel spring clamps and a 12AWG tin plated wire ordered in 8 in, 38 in, 76 in, and 96 in (203.2mm, 965.2mm, 1930.4mm, 2438.4mm) lengths. Grounding is accomplished by stainless steel spring clamps retention teeth that penetrate the anodized coating of the photovoltaic modules frame to contact the metal, creating a bonded connection from module to module.
- Position the DynoBond clip on the bottom lip flange of the first module. To engage the module frame fit the module's bottom lip flange between the toothed sections of the stainless steel spring clamp. Next, fit the adjacent module with the free end of the DynoBond clip. Leave slack in wire for expansion and contraction of module frame.
- DynoBond clips are for **SINGLE USE ONLY!** If a DynoBond is removed for any reason a new DynoBond must be used for replacement.

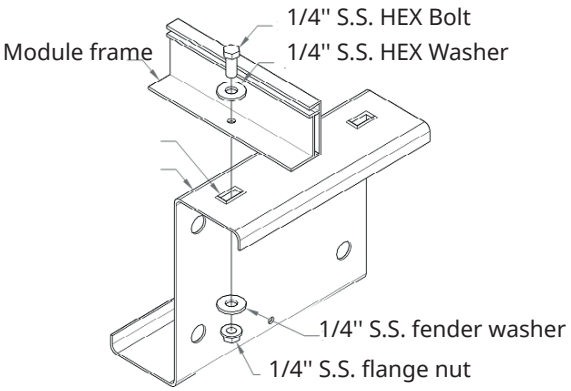


- Refer to DynoRaxx® DynoBond Installation Manual (publication no 090413) from DYNORAXX for more information. Always follow safety procedures when installing. Failure to follow the regulatory instructions will void Canadian Solar Inc. module warranty.

GROUNDING METHOD I
RBI SOLAR ¼" RAISED PURLIN MODULE BONDING

Only for use with RBI Solar Ground Mount System Model GM-I (Intertek classified)

- RBI Solar model GM-I has been tested and is certified as mounting system under UL Subject 2703, in particular its Raised Zee Purlin component has been approved for bonding with module frame.
- The raised Zee purlin integrated with pre-punched grounding holes is manufactured by RBI Solar Inc. Grounding is accomplished by the pre-punched raised holes that penetrate the anodized coating of the photovoltaic modules frame to contact the metal, creating a bonded connection from module to Zee Purlin.
- Assemble the fastening stainless steel hardware (1/4 in. hex bolt, 1/4 in. washer, 1/4 in. fender washer, 1/4 in. flange nut) to the grounding hole on the frame and the raised Zee purlin as shown in the picture.
- The correct placement of the frame and the zee purlin must be in vertical crossed orientation.
- A torque moment of 11 Nm (8.1 ft-lbs) should be used to fasten the grounding parts to module frame.



Refer to Ground Mount System Model GM-I module Installation Manual (14 April 2014,version 21) from RBI Solar for more information. Always follow safety procedures when installing. Failure to follow the regulatory instructions will void Canadian Solar Inc. module warranty.

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ANNEX C: MODULE SPECIFICATION

Standard Test Conditions are: irradiance of 1000 W/m^2, AM1.5 spectrum, and cell temperature of 25°C. The electrical characteristics are respectively within ±10% or [0; +5 W] of the indicated values for Isc, Voc and Pmax. Specifications are subject to change without notice.

Table 1: Specifications for CS-series photovoltaic modules under STC

Module Type	Maximum Power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimension <mm>	Weight <kg>
CS5A-195M	195.0	37	5.27	45	5.62	10.00	1595 × 801 × 40	15.3
CS5A-200M	200.0	37.4	5.35	45.3	5.71	10.00		
CS5A-205M	205.0	37.7	5.43	45.4	5.81	10.00		
CS5A-210M	210.0	38.1	5.51	45.6	5.90	10.00		
CS6C-140P	140.0	17.9	7.84	22.1	8.40	15.00	1485 × 666 × 40	12.0
CS6C-145P	145.0	17.9	8.09	22.2	8.65	15.00		
CS6C-150P	150.0	18.1	8.30	22.3	8.87	15.00		
CS6C-155P	155.0	18.1	8.54	22.4	9.09	15.00		
CS6P-200MX	200.0	29.2	6.86	36.5	7.56	15.00	1638 × 982 × 40	18.5 (CS6P-xxxM/MM) or 20.0 (CS6P-xxx-MX)
CS6P-205MX	205.0	29.2	7.02	36.5	7.66	15.00		
CS6P-210MX	210.0	29.3	7.17	36.7	7.77	15.00		
CS6P-215MX	215.0	29.3	7.33	36.8	7.89	15.00		
CS6P-220MX	220.0	29.5	7.45	36.9	7.97	15.00		
CS6P-225MX	225.0	29.7	7.58	37.0	8.07	15.00		
CS6P-230MX	230.0	29.9	7.70	37.1	8.22	15.00		
CS6P-235MX	235.0	30.1	7.82	37.2	8.34	15.00		
CS6P-240MX	240.0	30.2	7.95	37.3	8.46	15.00		
CS6P-245M/MX	245.0	30.3	8.09	37.4	8.61	15.00		
CS6P-250M/MX	250.0	30.4	8.22	37.5	8.74	15.00		
CS6P-255M/MX	255.0	30.5	8.35	37.7	8.87	15.00		
CS6P-260M/MM/MX	260.0	30.7	8.48	37.8	8.99	15.00		
CS6P-265 M/MM/MX	265.0	30.9	8.61	37.9	9.11	15.00		
CS6P-270M/MM/MX	270.0	31.1	8.67	38.2	9.19	15.00		
CS6P-275M/MM/MX	275.0	31.3	8.80	38.3	9.31	15.00		
CS6P-200PX	200.0	28.9	6.93	36.2	7.67	15.00	1638 × 982 × 40	18.5 (CS6P-xxxP) or 20.0 (CS6P-xxx-PX)
CS6P-205PX	205.0	28.9	7.09	36.2	7.78	15.00		
CS6P-210PX	210.0	29.0	7.25	36.4	7.89	15.00		
CS6P-215PX	215.0	29.0	7.40	36.5	8.01	15.00		
CS6P-220PX	220.0	29.2	7.53	36.6	8.09	15.00		
CS6P-225PX	225.0	29.4	7.65	36.7	8.19	15.00		
CS6P-230PX	230.0	29.6	7.78	36.8	8.34	15.00		

Module Type	Maximum Power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimension <mm>	Weight <kg>
CS6P-235PX	235.0	29.8	7.90	36.9	8.46	15.00	1638 × 982 × 40	18.5 (CS6P-xxxP) or 20.0 (CS6P-xxx-PX)
CS6P-240P/PX	240.0	29.9	8.03	37.0	8.59	15.00		
CS6P-245P/PX	245.0	30.0	8.17	37.1	8.74	15.00		
CS6P-250P/PX	250.0	30.1	8.30	37.2	8.87	15.00		
CS6P-255P/PX	255.0	30.2	8.43	37.4	9.00	15.00		
CS6P-260P/PX	260.0	30.4	8.56	37.5	9.12	15.00		
CS6P-265P/PX	265.0	30.6	8.66	37.7	9.23	15.00		
CS6P-270P/PX	270.0	30.8	8.75	37.9	9.32	15.00		
CS6P-275P/PX	275.0	31.0	8.88	38.0	9.45	15.00		
CS6A-160M	160.0	23.3	6.86	29.2	7.56	15.00	1324 × 984 × 40	15.5
CS6A-165M	165.0	23.4	7.06	29.2	7.71	15.00		
CS6A-170M	170.0	23.5	7.24	29.4	7.80	15.00		
CS6A-175M/MM	175.0	23.6	7.41	29.5	7.92	15.00		
CS6A-180M/MM	180.0	23.8	7.58	29.6	8.07	15.00		
CS6A-185M/MM	185.0	23.9	7.74	29.7	8.26	15.00		
CS6A-190M/MM	190.0	24.1	7.87	29.8	8.38	15.00		
CS6A-195M/MM	195.0	24.2	8.04	29.9	8.56	15.00		
CS6A-200M/MM	200.0	24.3	8.22	30.0	8.74	15.00		
CS6A-205M/MM	205.0	24.5	8.38	30.2	8.90	15.00		
CS6A-210M/MM	210.0	24.6	8.54	30.3	9.06	15.00		
CS6A-215M/MM	215.0	24.7	8.70	30.4	9.22	15.00		
CS6A-220M/MM	220.0	24.8	8.87	30.6	9.31	15.00		
CS6A-195P	195.0	24.0	8.13	29.6	8.69	15.00	1324 × 984 × 40	15.5
CS6A-200P	200.0	24.1	8.30	29.8	8.87	15.00		
CS6A-205P	205.0	24.2	8.47	29.9	9.03	15.00		
CS6A-210P	210.0	24.3	8.63	30.0	9.19	15.00		
CS6A-215P	215.0	24.5	8.78	30.2	9.35	15.00		
CS6A-220P	220.0	24.6	8.95	30.4	9.45	15.00		
CS6X-290P	290.0	35.9	8.08	44.4	8.64	15.00	1954 × 982 × 40	22.0 (3.2 mm Glass)
CS6X-295P	295.0	36.0	8.19	44.5	8.76	15.00		
CS6X-300P	300.0	36.1	8.30	44.6	8.87	15.00		
CS6X-305P	305.0	36.3	8.41	44.8	8.97	15.00		
CS6X-310P	310.0	36.4	8.52	44.9	9.08	15.00		
CS6X-315P	315.0	36.6	8.61	45.1	9.18	15.00		
CS6X-320P	320.0	36.8	8.69	45.3	9.26	15.00		
CS6X-325P	325.0	37.0	8.78	45.5	9.34	15.00		
CS6X-330P	330.0	37.2	8.88	45.6	9.45	15.00		
CS6V-200M	200.0	25.2	7.95	31.1	8.46	15.00	1638 × 826 × 40	16.0
CS6V-205M	205.0	25.3	8.11	31.2	8.63	15.00		
CS6V-210M/MM	210.0	25.4	8.27	31.3	8.79	15.00		
CS6V-215M/MM	215.0	25.5	8.43	31.5	8.94	15.00		
CS6V-220M/MM	220.0	25.7	8.56	31.6	9.08	15.00		
CS6V-225M/MM	225.0	26.0	8.67	31.8	9.19	15.00		
CS6V-230M/MM	230.0	26.1	8.81	31.9	9.33	15.00		
CS6V-235MM	235.0	26.4	8.91	32.1	9.45	15.00		

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Module Type	Maximum Power Pmax <W>	Operating voltage Vmp <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimension <mm>	Weight <kg>
CS6VH-100M/MM	100.0	12.6	7.95	15.5	8.46	15.00	844 × 826 × 40	9.0
CS6VH-105M/MM	105.0	12.7	8.27	15.7	8.78	15.00		
CS6VH-110M/MM	110.0	12.9	8.55	15.8	9.07	15.00		
CS6VH-115M/MM	115.0	13.1	8.80	16.0	9.32	15.00		
CS6VH-120MM	120.0	13.4	8.99	16.1	9.56	15.00		
CS6V-190P	190.0	24.6	7.73	30.6	8.28	15.00	1638 × 826 × 40	16.0
CS6V-195P	195.0	24.8	7.87	30.7	8.44	15.00		
CS6V-200P	200.0	24.9	8.03	30.8	8.59	15.00		
CS6V-205P	205.0	25.0	8.19	30.9	8.76	15.00		
CS6V-210P	210.0	25.1	8.35	31.1	8.92	15.00		
CS6V-215P	215.0	25.3	8.51	31.2	9.07	15.00		
CS6V-220P	220.0	25.5	8.64	31.4	9.21	15.00		
CS6V-225P	225.0	25.7	8.75	31.6	9.32	15.00		
CS6V-230P	230.0	25.9	8.90	31.7	9.47	15.00		
CS6VH-95P	95.0	12.3	7.7	15.3	8.28	15.00	844 × 826 × 40	9.0
CS6VH-100P	100.0	12.5	8.03	15.4	8.59	15.00		
CS6VH-105P	105.0	12.6	8.35	15.5	8.91	15.00		
CS6VH-110P	110.0	12.7	8.63	15.7	9.2	15.00		
CS6VH-115P	115.0	12.9	8.88	15.8	9.46	15.00		
CS6K-210P	210.0	29.0	7.25	36.4	7.89	15.00	1650 × 992 × 40	19.0
CS6K-215P	215.0	29.0	7.40	36.5	8.01	15.00		
CS6K-220P	220.0	29.2	7.53	36.6	8.09	15.00		
CS6K-225P	225.0	29.4	7.65	36.7	8.19	15.00		
CS6K-230P	230.0	29.6	7.78	36.8	8.34	15.00		
CS6K-235P	235.0	29.8	7.90	36.9	8.46	15.00		
CS6K-240P	240.0	29.9	8.03	37.0	8.59	15.00		
CS6K-245P	245.0	30.0	8.17	37.1	8.74	15.00		
CS6K-250P	250.0	30.1	8.30	37.2	8.87	15.00		
CS6K-255P	255.0	30.2	8.43	37.4	9.00	15.00		
CS6K-260P	260.0	30.4	8.56	37.5	9.12	15.00		
CS6K-265P	265.0	30.6	8.66	37.7	9.23	15.00		
CS6K-270P	270.0	30.8	8.75	37.9	9.32	15.00		
CS6K-275P	275.0	31.0	8.88	38.0	9.45	15.00		
CS6K-220M/MM	220.0	29.5	7.45	36.9	7.97	15.00		
CS6K-225M/MM	225.0	29.7	7.58	37.0	8.07	15.00		
CS6K-230M/MM	230.0	29.9	7.70	37.1	8.22	15.00		
CS6K-235M/MM	235.0	30.1	7.82	37.2	8.34	15.00		
CS6K-240M/MM	240.0	30.2	7.95	37.3	8.46	15.00		
CS6K-245M/MM	245.0	30.3	8.09	37.4	8.61	15.00		
CS6K-250M/MM	250.0	30.4	8.22	37.5	8.74	15.00		
CS6K-255M/MM	255.0	30.5	8.35	37.7	8.87	15.00		
CS6K-260M/MM	260.0	30.7	8.48	37.8	8.99	15.00		
CS6K-265 M/MM	265.0	30.9	8.61	37.9	9.11	15.00		
CS6K-270M/MM	270.0	31.1	8.67	38.2	9.19	15.00		
CS6K-275M/MM	275.0	31.3	8.80	38.3	9.31	15.00		

ANNEX D: MODULE CLEANING GUIDELINE

This manual covers requirements for the cleaning procedure of Canadian Solar Inc. photovoltaic modules. The purpose of these cleaning guidelines is to provide general information for cleaning Canadian Solar modules. Professional installer should read these guidelines carefully and strictly follow these instructions.

Failure to follow these instructions may result in death, injury or property damage to photovoltaic module. Damages induced by inappropriate cleaning procedures will void Canadian Solar warranty.

SAFETY WARNING

- Cleaning activities create risk of damaging the modules and array components, as well as increasing the potential electric shock hazard.
- Cracked or broken modules represent an electric shock hazard due to leakage currents, and the risk of shock is increased when modules are wet. Before cleaning, thoroughly inspect modules for cracks, damage, and loose connections.
- The voltage and current present in an array during daylight hours are sufficient to cause a lethal electrical shock.
- Ensure that the circuit is disconnected before starting the cleaning procedure as contact with leakage of electrically active parts can result in injury.
- Ensure that the array has been disconnected to other active components (such as inverter or combiner boxes) before starting with the cleaning.
- Wear suitable protection (Clothes, insulated gloves, etc.).
- **Do not** immerse the module, partially or totally, in water or any other cleaning solution.

HANDLING NOTICE

- Use a proper cleaning solution and suitable cleaning equipment.
- **Do not** use abrasive or electric cleaners on the module.
- Particular attention should be taken to avoid the module backsheet or frame to come in contact with sharp objects, as scratches may directly affect product safety.
- **Do not** use de-greasers on the module.
- **Do not** use cleaning corrosive solutions containing acid, alkali, acetone, or industrial alcohol.
- Canadian Solar Inc. recommends to avoid rotating brush cleaning method, as it can lead to the formation of micro cracks.
- Dirt must never be scraped or rubbed away when dry, as this will cause micro-scratches on the glass surface.

OPERATION PREPARATION

- Noticeable dirt must be rubbed away by gentle cleaning implement (soft cloth, sponge or brush with soft bristles).
- Ensure that brushes or agitating tools are not abrasive to glass, EPDM, silicone, aluminum, or steel.
- Conduct the cleaning activities avoiding the hottest hours of the day, in order to avoid thermal stress on the module.

Recommended the following to be used:
- Water with low mineral content
- Near neutral PH water
- The maximum water pressure recommended is 4 MPa (40 bar)

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CLEANING METHODS

Method A: Compressed Air

Canadian Solar Inc. recommends cleaning the soft dirt (like dust) on modules just with air pressure. This technique can be applied as long as the method is efficient enough considering the existing conditions.

Method B: Wet cleaning

If excessive soiling is present on module surface, a non-conductive brush, sponge, or other mild agitating method may be used with caution.

- Ensure that any brushes or agitating tools are constructed with non-conductive materials to minimize risk of electric shock and that they are not abrasive to the glass or the aluminum frame.

- If grease is present, an environmental friendly cleaning agent may be used with caution.

AMENDMENT EDITIONS AND DATES

- The first edition Rev A1 is released in Apr, 2014.
- The second edition Rev A2 is released in Dec, 2014

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